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Research Note

Notes on the fecundity of several Central and South American blackflies[1)]

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Determination of physiological age of vector insects is indispensable to investigate the transmission of insect-borne diseases. The ovarian changes following oviposition as the indicator of parity were well recognized in mosquito studies and were applied to blackflies. However, apart from a distinction between nulliparous and parous females, it is difficult to distinguish the number of gonotrophic cycles among parous blackflies (Garms, 1975; Cupp and Collins, 1979; Watanabe *et al.*, 1980). Recently, Mokry (1980) suggested that the estimation of aging is feasible by the observation of the fecundity in African vector of onchocerciasis, *Simulium damnosum s.l.* Moreover, information on the fecundity itself will be important to understand the vector population biology.

In our work, four blackfly species in Guatemala and Venezuela were examined for the number of eggs matured after blood feeding, and some factors affecting the fecundity are discussed.

Materials and Methods: Four blackfly species were selected as the materials; *S. ochraceum* and *S. haematopotum* in Guatemala, *S. metallicum* in northern Venezuela and *S. pintoi* in southern Venezuela. It is well known that the first species is the main vector of *Onchocerca volvulus* in Guatemala (Dalmat, 1955) and the second one is experimentally able to support the development of this parasite to infective stage (Takaoka *et al.*, 1984a). The latter two Venezuelan species are thought to be responsible for *Onchocerca* transmission in the respective area (Peñalver, 1961; Takaoka *et al.*, 1984b).

Collections of flies were carried out in September 1982 at Finca Rincón, Department of Guatemala and at Finca Santa Inés, Department of Suchitepequez for *S. ochraceum* and at Mixco Viejo, Department of Chimaltenango for *S. haematopotum* in Guatemala. In Venezuela, *S. metallicum* were collected at Guanaguana in Monagas State and *S. pintoi* at Parima mountain region of the Federal Territory of Amazonas during October and November 1982. Wild flies were allowed to feed to repletion on volunteers with onchocerciasis and collected individually in a polystyrene tube. They were maintained at constant temperature (22°C for *S. ochraceum* and *S. haematopotum*) or room temperature (22–28°C for *S. metalli-*

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cum and 16–24°C for *S. pintoi*) by the method of Takaoka *et al.* (1982). In Guatemala, flies which died after 2 days post-feeding were removed every day and dissected in a drop of saline to count the number of maturing oocytes. Venezuelan specimens removed in a similar way were preserved in 70% ethanol until later dissection. Wing length (from proximal end of basal section of radius to wing tip) was also measured on some of *S. metallicum* and *S. pintoi*. The flies infected with fungi were excluded from analysis since their ovaries were destroyed completely or at least partially.

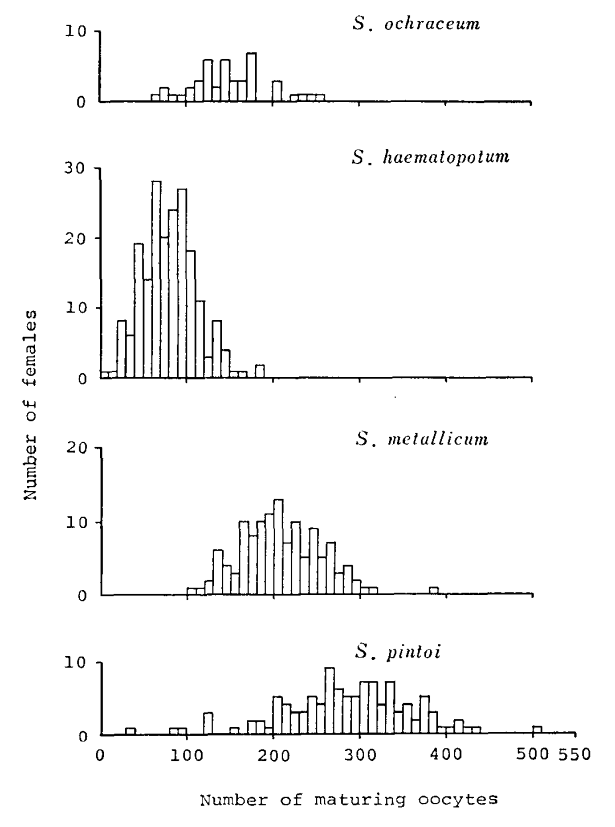


Fig. 1 Frequency distribution of maturing oocytes for Guatemalan (*S. ochraceum* and *S. haematopotum*) and Venezuelan (*S. metallicum* and *S. pintoi*) blackflies with 10 eggs interval.

Results and Discussion: A total of 44, 196, 124 and 110 females were dissected for *S. ochraceum, S. haematopotum, S. metallicum* and *S. pintoi,* respectively. Figure 1 illustrates the frequency distribution of the number of maturing oocytes (fecundity) per fly for each species. Though *S. ochraceum* were captured at two localities, the data were pooled since there was no significant difference in the fecundity between localities. Mean fecundity was 150.2±44.8 (S.D.) and 81.5±32.1 for Guatemalan blackflies, *S. ochraceum* and *S. haematopotum,* and 209.3±47.8 and 282.4±81.5 for Venezuelan species, *S. metallicum* and *S. pintoi,* respectively. *Simulium pintoi* developed the highest number of eggs, followed by *S. metallicum, S. ochraceum* and *S. haematopotum*. It will be noteworthy that there were marked differences in the fecundity among species and the order corresponded to the difference of their body sizes.

The fecundities of Venezuelan blackflies

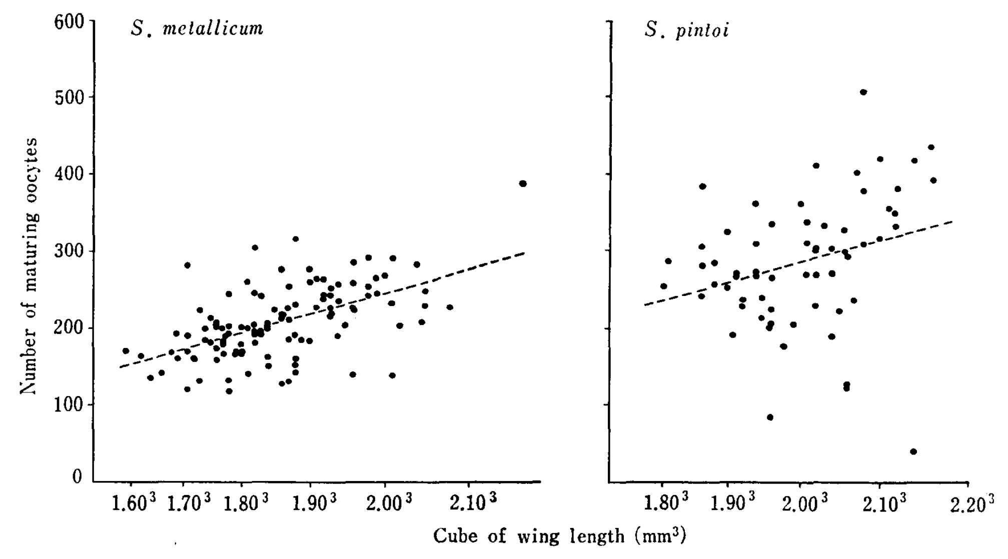


Fig. 2 The numbers of maturing oocytes in *S. metallicum* and *S. pintoi* plotted against the cubes of the wing lengths of the flies. Broken line indicates the regression.

were significantly correlated with their body sizes (Fig. 2). In this figure, the cubes of the wing lengths of the flies were used to estimate volumetric differences. Correlation equation was $Y=23.97X+54.90$ ($N=113$, $r=0.56$, $p<0.01$) for *S. metallicum* and $Y=22.37X+107.40$ ($N=63$, $r=0.28$, $p<0.05$) for *S. pintoi,* where X was the cube of the wing length (mm) and Y was the fecundity.

Cheke *et al.* (1982) suggested the detrimental effect of *Onchocerca* spp. infection on the fecundity of *S. damnosum s.l.* Ham and Banya (1984) also pointed out that *O. lienalis* infection reduced the fecundity of *S. ornatum s.l.* and *S. lineatum.* Although the effect of microfilariae and/or earlier developmental stages of *O. volvulus* could not be evaluated, it might be negligible at least for *S. ochraceum* since fecundity observed in this species was comparable to, or slightly more than, the mean number of ovarioles of wild females, *i.e.* about 120, reported by Watanabe *et al.* (1980).

Mokry (1980) recognized clearly the groups in frequency distribution of the fecundity in *S. damnosum s.l.* and considered them as the reflection of age composition. On the other hand, as seen in Fig. 1, there was no prominent separation in frequency distribution of the fecundity in all species examined. It is difficult to explain the discrepancy between Mokry's result and ours, but it may be considered that the fecundity of blackfly is influenced by at least three factors, body size, parasite infection and aging as mentioned above. In addition to these factors, incomplete blood meal may reduce the number of oocytes matured (Takaoka, 1973). The combination of these factors might obscure the clear-cut decrease of fecundity, if any, after each oviposition in this study. Further studies on the quantitative evaluation of the influence of each factor are required.

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摘　　要

中南米産ブユ数種の蔵卵数

グァテマラ産 *S. ochraceum*, *S. haematopotum* およびベネズエラ産 *S. metallicum*, *S. pintoi* について，吸血後の発育卵数を調べた．平均蔵卵数はおのおの，150.2±44.8 (S.D.)，81.5±32.1，209.3±47.8 および 282.4±81.5 であった．また，*S. metallicum* および *S. pintoi* について翅長と蔵卵数の関係をみると有意な相関があった．これらの結果と蔵卵数に影響する要因について考察した．